**International Journal of Computer Networking,
Wireless and Mobile Communications (IJCNWMC)
ISSN(P): 2250-1568; ISSN(E): 2278-9448
Vol. 5, Issue 1, Feb 2015, 27-34**

ROUTE REDISTRIBUTION BETWEEN EIGRP AND OSPF ROUTING PROTOCOL IN COMPUTER NETWORK USING GNS3 SOFWARE

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ABSTRACT

Routing plays very significant role to advertising the route of one network to another network as well to find the best path between source to destination. In computing environment so many routing protocol like EIGRP and OSPF are used for sending IP packet from source to destination. But different routing protocol used different routing algorithm to find best path between source to destination node. Whereas EIGRP is a Cisco Propertiary protocol that runs only Cisco router and OSPF is non Cisco Propertiary protocol that runs. So packet of EIGRP network cannot reach to OSPF network. So this research paper mainly focuses on to solve this problem by using Route Redistribution technique. Route redistribution (RR) has become an integral part of IP network design. Using this technique we can optimize the network by advertising the EIGRP route to OSPF network and vice versa.

KEYWORDS: CISCO, RIP, EIGRP, OSPF, BGP, RR, AS

INTRODUCTION

Routing is a process of exchanging IP packet from one network to another network. It also provide find the best path for IP packet between source to destination with the help of Router. Router works at network layer of the OSI model and used to route IP packets to destination networks. This is possible as router used routing technique like static, default and dynamic routing. Static and default routing is configure by administrator manually. In dynamic routing, router used various routing protocol such as RIP, EIGRP and OSPF etc. Basically router performed routing to create a routing table and learn the neighbor route information [12, 15].

TYPES OF ROUTING

Routing can be classified into two main categories according to create a routing table

- Static
- Dynamic routing

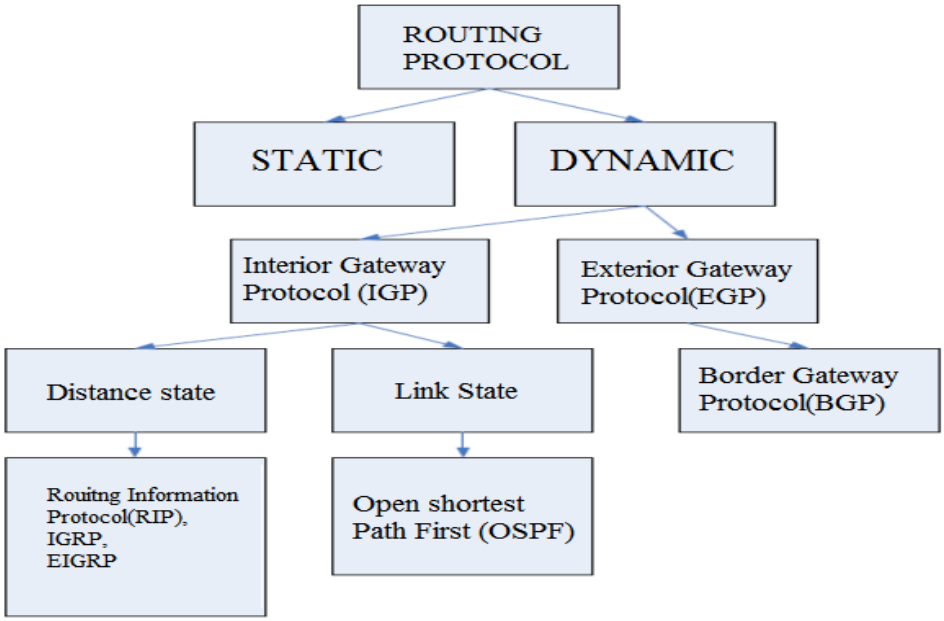
- **Static Routing**

In computer networking, the word static means manually. So in process administrator configure each router interface manually. So routing table is created, update and maintained by administrator manually, in this process router will not share our routing information with each other thus it reduced CPU/RAM overhead so as the result bandwidth is saved [12, 15].

- **Dynamic Routing**

In this routing, router learn all the routing update and other information with help of using routing protocol like RIP, EIGRP, OSPF and BGP etc. These are further divided into two categories like interior and exterior routing. Interior routing protocol are implemented in single AS. Like RIP, EIGRP and OSPF whereas exterior routing protocol are implemented in two or more ASs like BGP and EGP etc

Table 1: Routing Overview of OSPF & EIGRP



ROUTING OVERVIEW OF OSPF & EIGRP

OSPF is a interior gateway dynamic routing protocol developed by IETF which implemented in single AS (Autonomous system). it uses link state routing algorithm or shortest path first algorithm. It find the shortest path route based on Dijkstra's algorithm. It support VLSM/classless routing. It is non Cisco Propertiary protocol that runs on any vendor router. Each router has an identical database. Each piece of this database describes a specific router and its current state, which includes the state of the interfaces, reachable neighbours, and other information. The router distributes this information about the Autonomous System by "flooding". Each router runs the algorithm in parallel with other SPF routers, and from the internal database, constructs a tree of shortest paths with itself as the root. The tree contains a route to each destination in the Autonomous System. External routes are added to the tree as "leaves". OSPF allows the grouping of networks into a set, called an *area*.

Enhanced Interior Gateway Routing Protocol (EIGRP) or Enhanced IGRP is a interior gateway routing protocol which are Cisco proprietary routing protocol utilizing the Diffusing Update Algorithm (DUAL). It is a hybrid protocol as it incorporates features of a Distance Vector routing protocol and features of a Link State routing protocol. Update— Update packets contain EIGRP routing updates sent to an EIGRP neighbour.

Query: Queries are sent to neighbours when a route is not available and the router needs to ask the status of the route for fast convergence.

Reply: Reply packets to the queries contain the status of the route being queried for.

Table 2: Comparison between EIGRP and OSPF Routing Protocol

S. No	Parameters	EIGRP	OSPF
1.	Type of Protocol	Distance Vector	Link State
2.	Path Metric	Delay, Bandwidth, Reliability, load	Bandwidth
3.	Routes	IP, IPX, Apple Talk	IP
4.	Hop Count	255	None
5.	Sub netting	VLSM	VLSM
6.	Summarization	Network Class Address/Subnet Boundary	Network Class Address/Subnet Boundary
7.	Convergence	Fast	Fast
8.	Routing Advertisement	Dual	Partial
9.	Route Computation	Bandwidth*Delay*256	Dijkstra
10.	Metric Calculation	No	100/Bandwidth (Mbps)
11.	Hierarchal Network	5 Sec	10 sec
12	Hello Timer	15 Sec	40 sec

ROUTE OPTIMIZATION USING ROUTE REDISTRIBUTION

It is preferable to employ a single routing protocol in an internetwork environment, for simplicity and ease of management. Unfortunately, this is not always possible, making multi-protocol environments common. The use of a routing protocol to advertise routes that they are learned by another routing protocol such as static routes or directly connected routes is called redistribution. Whereas running one routing protocol throughout your entire IP internetwork is desirable, multi-protocol routing is common for variety of reasons, such as company mergers, multiple departments managed by multiple network administrators and multi-vendor environments[16]. Route redistribution can be one-way (that is, one protocol receives the routes from another) or two-way (that is, both protocols receive routes from each other). Routers that perform redistribution are called boundary routers because they border two or more ASs or routing domains. [16]

Need of Route Redistribution

- To allow multivendor interoperability (OSPF on non- Cisco, EIGRP on Cisco).
- Design low cost effective network and upgrade old protocol to new protocol.
- Company has connections between business different partners.
- Company has different divisions with the network under separate control for business or political reasons.

RELATED WORK

Fatima A. H. et al.(2011) has evaluated Performance Comparison of Two Dynamic Routing Protocols: RIP and OSPF using Network Simulator (NS2) to obtain the performance results of the two classes using different metrics such as throughput, packet delay and packet loss. Results of the simulation show that OSPF has a better performance than RIP in terms of average throughput and packet delay in different network sizes.

Z-Z Wei et. al [2011] have proposed a simple and practical approach to strengthen the reliability without any modification on BGP using redistribution & result shows that this method can reduce packet loss during link failures significantly.

Gundalwar P. R. et al.(2013) have discuss issues from the basic working concept of a RIP to experimental setup used in IP networks using OPNET IT Guru Academic Edition Simulator, stability features, message formats etc. He concluded that RIP works unusual with different sense regarding failure or no failure in the network. We compare RIP with other Interior Gateway Protocol (IGP) for comparison in future work.

Adhikari J. (2013) has analyzed the performance of Protocols RIP & EIGRP using GNS3 Software. He compared that both the protocols & concluded that the EIGRP protocol is better than RIP protocol.

Shah A. et al. (2013) evaluated the comparison of RIP and OSPF protocols on the basis of convergence, traffic and CPU utilization by changing special parameters within network using OPNET as simulating tool. They have concluded that OSPF network convergence is faster as compare to RIP convergence Vetriselvan V. et al. (2014) surveyed the Performance evaluation of various routing protocols. With certain criteria's like Jitter, Convergence Time, end to end delay. They have concluded that EIGRP has better than OSPF. Sonam .et al.(2014) have analyzed that fastest Ftp download response time IS-IS should be preferred for 800 and 1000 packets whereas slowest response is obtained by RIP protocol. Kumar J. et al. (2013) have analyzed performance analysis between static and dynamic routing using CISCO packet tracer. They have concluded that dynamic routing is better than static routing for a large network. S. Bakhsi et. al[2013] have analyzed simulation based study between EIGRP, BGP and OSPF. In order to evaluate the performance of EIGRP and BGP three network scenarios are configured viz route redistribution, FFC with route redistribution and to fasten the BGP process the header changes are done. Komal N. et al. [2014] analyzed dynamic routing protocols between EIGRP and OSPF using OPNET. They concluded that EIGRP have fast database query response time and/or E-mail download response time, EIGRP should be preferred over the OSPF and their combination OSPF-EIGRP. Kumar J. et al. (2015) have analyzed Performance Analysis of RIPv2 protocol in Wired Network Using Cisco Packet Tracer. They have concluded that the performance of RIPv2 protocol is enhanced by three times improved then existing results.

SIMULATION SETUP

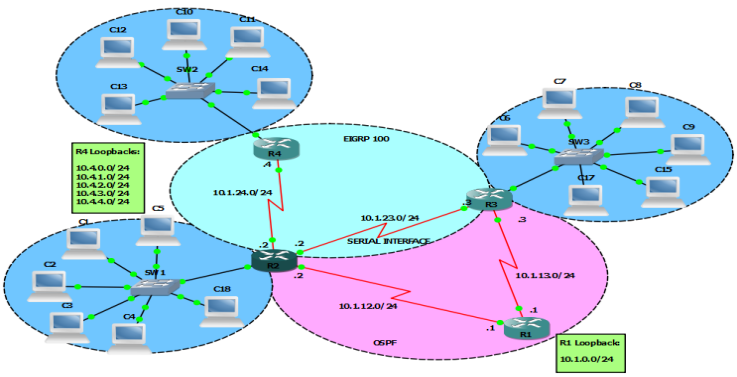


Figure 1: Simulation of Route Redistribution between OSPF and EIGRP in GNS-3 Software

Figure 1 shows the simulation of dynamic routing using GNS 3 software. We have developed a simulation networking model consist of Cisco router, Non Cisco router, switches and make a physical connection by connecting cable to serial and fast Ethernet by using simulation tool GNS 3 Software

Configuring CISCO Router- After implementation of physical model we are required to configuring of network with static routing means we are configure all router interface manually. Router will be configure in two ways-

- **GUI (Graphical User Interface):** With GUI we simply configure router by clicking the router then click configuration and then selected which type of configuration you want to configure.
- **CLI (Command Line Interface) Mode:** In this mode, we can configure dynamic routing with the of various command [12, 15].

SIMULATION

Table 3: Check Connectivity for Assign IP Address Interface at Router (R4)

```
R4#sh ip int br
Interface                  IP-Address      OK? Method Status                Protocol
FastEthernet0/0            unassigned      YES NVRAM  administratively down down
Serial0/0                  10.1.24.4       YES NVRAM  up                    up
FastEthernet0/1            unassigned      YES NVRAM  administratively down down
Serial0/1                  unassigned      YES NVRAM  administratively down down
Loopback0                  10.4.0.1        YES NVRAM  up                    up
Loopback1                  10.4.1.1        YES NVRAM  up                    up
Loopback2                  10.4.2.1        YES NVRAM  up                    up
Loopback3                  10.4.3.1        YES NVRAM  up                    up
Loopback4                  10.4.4.1        YES NVRAM  up                    up
R4#ping 10.1.24.4

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.24.4, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 8/15/36 ms
R4#ping 10.4.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.4.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 4/4/4 ms
R4#ping 10.4.4.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.4.4.1, timeout is 2 seconds:
!!!!!
```

Table 3 Show that connectivity of various interfaces. Status column indicated that physical layer connectivity of the interface and Protocol column indicated that data link layer connectivity up or down. We have implemented routing technique dynamic routing.

Table 4: Check EIGRP Protocol at Boundary Router (R2)

```
R2#SH IP ROute
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 10 subnets
O       10.1.13.0 [110/128] via 10.1.12.1, 02:20:52, Serial0/1
C       10.1.12.0 is directly connected, Serial0/1
D       10.4.4.0 [90/2297856] via 10.1.24.4, 02:22:08, Serial0/2
O       10.1.0.0 [110/65] via 10.1.12.1, 02:20:52, Serial0/1
D       10.4.2.0 [90/2297856] via 10.1.24.4, 02:22:08, Serial0/2
D       10.4.3.0 [90/2297856] via 10.1.24.4, 02:22:08, Serial0/2
D       10.4.0.0 [90/2297856] via 10.1.24.4, 02:22:08, Serial0/2
D       10.4.1.0 [90/2297856] via 10.1.24.4, 02:22:09, Serial0/2
C       10.1.24.0 is directly connected, Serial0/2
C       10.1.23.0 is directly connected, Serial0/0
```

In Table 4 “D” Represented that EIGRP are configure on Router 2 and similarly we also check on Router (R4) and Router (R3) using command show ip route.

Table 5: Check OSPF Protocol at Boundary Router (R2)

```
R2#sh ip ro
R2#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 10 subnets
O       10.1.13.0 [110/128] via 10.1.12.1, 02:16:32, Serial0/1
C       10.1.12.0 is directly connected, Serial0/1
D       10.4.4.0 [90/2297856] via 10.1.24.4, 02:19:07, Serial0/2
O       10.1.0.0 [110/65] via 10.1.12.1, 02:16:32, Serial0/1
D       10.4.2.0 [90/2297856] via 10.1.24.4, 02:19:07, Serial0/2
D       10.4.3.0 [90/2297856] via 10.1.24.4, 02:19:07, Serial0/2
D       10.4.0.0 [90/2297856] via 10.1.24.4, 02:19:07, Serial0/2
D       10.4.1.0 [90/2297856] via 10.1.24.4, 02:19:08, Serial0/2
C       10.1.24.0 is directly connected, Serial0/2
C       10.1.23.0 is directly connected, Serial0/0
```

In Table 5 “O” Represented that OSPF routes are configure on that particular interface of Router 2(R2) using show ip route command on R2 we can check it “C’’ Represent directly connected route of Router 2 (R2). We configure two way Route Redistributions on border area Router (R2) and Router (R3).

Table 6: Check Route Redistribution OSPF into EIGRP Network at Router (R1)

```
R1#sh ip route
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 9 subnets
C       10.1.13.0 is directly connected, Serial0/1
C       10.1.12.0 is directly connected, Serial0/0
C       10.1.0.0 is directly connected, Loopback0
O E2    10.4.2.0 [110/200] via 10.1.12.2, 00:53:30, Serial0/0
O E2    10.4.3.0 [110/200] via 10.1.12.2, 00:53:30, Serial0/0
O E2    10.4.0.0 [110/100] via 10.1.12.2, 00:53:30, Serial0/0
O E2    10.4.1.0 [110/100] via 10.1.12.2, 00:53:30, Serial0/0
O       10.1.24.0 [110/128] via 10.1.12.2, 00:53:30, Serial0/0
O       10.1.23.0 [110/128] via 10.1.12.2, 00:53:32, Serial0/0
```

In Table 6 “E2” Represented that External OSPF Routes are Redistributed into EIGRP Network at Router 1(R1). This is one way Route Redistribution it means that EIGRP Networking device can send packet to OSPF Network but OSPF device cannot send packet into EIGRP domain

Table 7: Check Route Redistribution EIGRP into OSPF Network at Router (R4)

```
R4#SH IP ROute
Codes: C - connected, S - static, R - RIP, M - mobile, B - BGP
       D - EIGRP, EX - EIGRP external, O - OSPF, IA - OSPF inter area
       N1 - OSPF NSSA external type 1, N2 - OSPF NSSA external type 2
       E1 - OSPF external type 1, E2 - OSPF external type 2
       i - IS-IS, su - IS-IS summary, L1 - IS-IS level-1, L2 - IS-IS level-2
       ia - IS-IS inter area, * - candidate default, U - per-user static route
       o - ODR, P - periodic downloaded static route

Gateway of last resort is not set

     10.0.0.0/24 is subnetted, 10 subnets
D EX     10.1.13.0 [170/6917120] via 10.1.24.2, 04:09:16, Serial0/0
D        10.1.12.0 [90/2681856] via 10.1.24.2, 04:10:33, Serial0/0
C        10.4.4.0 is directly connected, Loopback4
D EX     10.1.0.0 [170/6917120] via 10.1.24.2, 04:10:32, Serial0/0
C        10.4.2.0 is directly connected, Loopback2
C        10.4.3.0 is directly connected, Loopback3
C        10.4.0.0 is directly connected, Loopback0
C        10.4.1.0 is directly connected, Loopback1
C        10.1.24.0 is directly connected, Serial0/0
D        10.1.23.0 [90/2681856] via 10.1.24.2, 04:09:23, Serial0/0
R4#PING 10.1.13.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.13.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/31/48 ms
R4#PING 10.1.0.1

Type escape sequence to abort.
Sending 5, 100-byte ICMP Echos to 10.1.0.1, timeout is 2 seconds:
!!!!!
Success rate is 100 percent (5/5), round-trip min/avg/max = 20/44/60 ms
```

In Table 6 “EX” Represented that External EIGRP Routes are redistributed into OSPF Network at Router 4(R4). This is also one way Route Redistribution it means that OSPF Networking device can send packet to EIGRP Network but EIGRP device cannot send packet into OSPF domain. But we used Two way redistribution between EIGRP and OSPF. So we send packet to EIGRP to OSPF domain and OSPF into EIGRP domain.

CONCLUSIONS

Dynamic routing used different routing protocol which are vendor proprietary (like RIP, EIGRP) or Non-vendor proprietary (OSPF) if we provide routing between vendor proprietary(RIP,EIGRP) and Non-vendor proprietary (OSPF). So Route redistribution (RR) has become an integral part of IP network design. Route redistribution provide important role to redistributed one route to another network. Basically it translates one routing protocol into another routing protocol with losing its information. It allow multivendor but the main limitation is that when any route is lost then looping problem is occurs. Another technique is used to optimize the route like passive interface and route filter and policy routing.

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